Space Weather Technical Forecast

Issued on Wednesday, 12 June 2024 at 12:13 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of isolated M-flares (R1-R2 radio blackouts). Chance of Minor solar radiation storm (S1) initially, this risk declining into the period.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity is Low with only C-class activity over the last 24hrs, peaking with a C3.6 flare at 12/0521 UTC from a new region on the southeast limb. There are currently seven sunspot regions on the visible disc, with two recently numbered regions developing near the southeast limb. AR3709 in the southeast remains the largest region. It consists of a larger leader spot surrounded by some smaller trailing spots, although recent growth has stalled and some simplification has occurred. The two new regions in the southeast have shown some growth, and will be analysed further as they rotate more into view. The remaining regions are mostly simple and stable with a couple of previous spots fading or rotating off the visible disc.

No Earth-directed CMEs have been observed in the past 24 hours. A recent Type II radio burst and significant field line opening on SDO imagery suggest a flare and far-sided CME from a region around the west limb.

Solar Wind / Geomagnetic Activity: Solar winds, as observed by ACE at L1, generally declined from a peak around 410 km/s early in the period towards current speeds of around 350 km/s. Density was average to below average throughout. The IMF (Interplanetary Magnetic Field), Bt, was weak throughout, ranging between 1-6 nT. The north-south component, Bz, was also weak, ranging between +5 and -3 nT. The phi angle was predominantly positive (away from the Sun), with only brief negative intervals (towards the Sun). Geomagnetic activity was Quiet throughout (Kp1-2).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 rose following the far-sided CME, almost reaching S1/Minor solar radiation storm levels.

High energy electron flux (greater than 2MeV) observed by GOES16 was at background levels, with the associated 24-hour fluence well below Active. Observed fluence at 12/0000 UTC was 1.09e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a chance of isolated M-class flares, with just a slight chance of X-flares initially, most probably from the declining AR3697 in the short term. The flare risk reduces into the period pending further developments.

Solar Wind / Geomagnetic Activity: Solar wind speeds are now at background levels following recent CME influence and are currently expected to remain so through much of the period.

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Overall, geomagnetic activity is likely to be mostly Quiet (Kp1-2), with a chance of Unsettled (Kp3) intervals during Days 3 and 4 (14-15 Jun) due to any weak high speed stream influence.

Energetic Particles / Solar Radiation: High energy proton flux is currently close to S1/Minor solar radiation storm levels after a recent far-sided CME. It is expected to ease over the coming day, but a chance for further enhancement remains, with the risk of S1 maintained for Day 1 (12 Jun), before easing over subsequent days.

High energy electron flux is forecast to persist at predominantly background levels, and the associated 24-hour fluence is expected to remain below the Active threshold.

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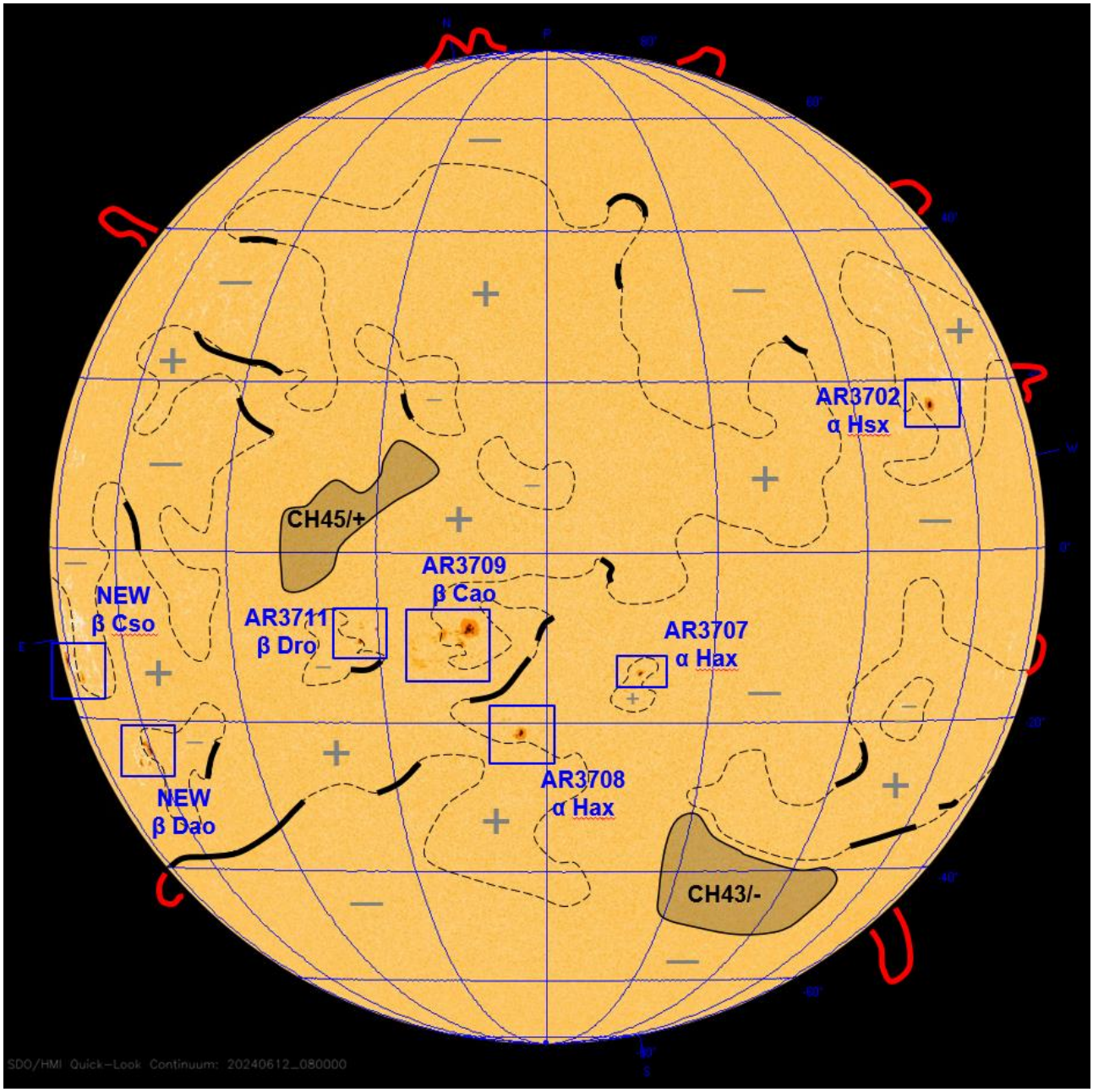
Figure 1. Solar Analysis Valid 12/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:
No Earth-directed CMEs currently feature in the forecast.

Solar wind speeds are now at background levels following recent CME influence and are currently expected to remain so through much of the period. No significant coronal hole enhancements are expected through the period. A small coronal hole near south-centre disc has now closed and faded from view, but not much was forecast from this region with limited geomagnetic response expected.

Overall, geomagnetic activity is likely to be mostly Quiet (Kp1-2), with a chance of Unsettled (Kp3) intervals during Days 3 and 4 (14-15 Jun) due to any weak high speed stream influence.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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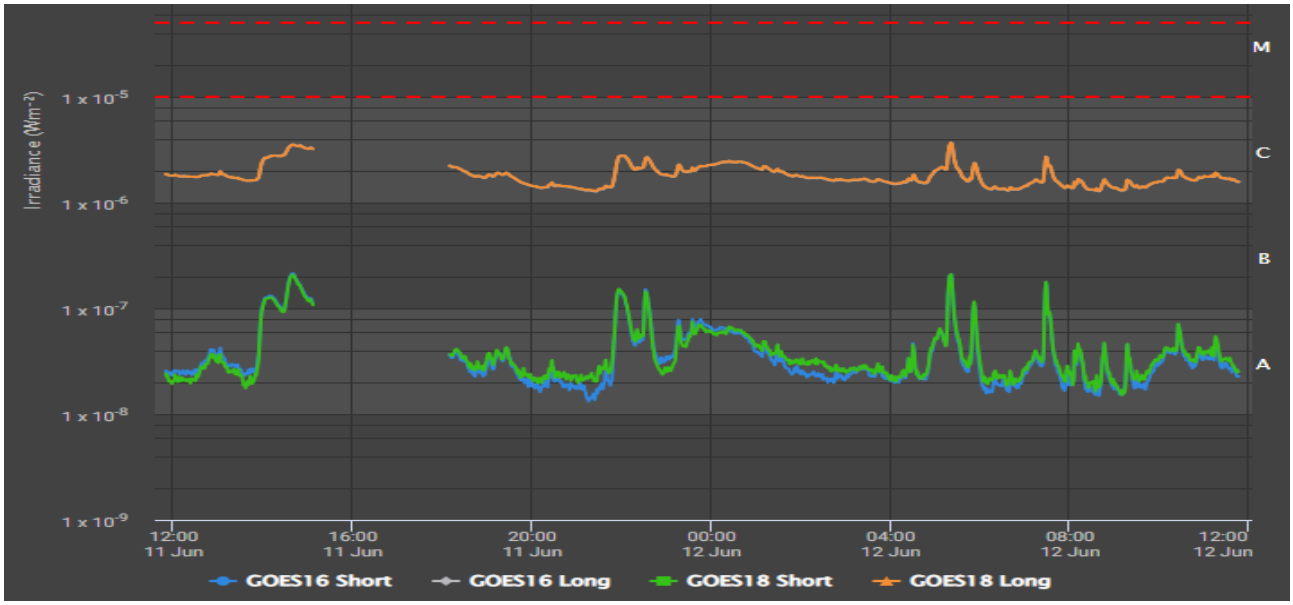
Radio Blackouts - X-Ray Flares:

There are currently seven sunspot regions on the visible disc, with two newly numbered regions in the southeast. Activity has been quiet with AR3697 now further around the western limb, however it still enters into considerations with regards to flare risk on Day 1 (12 Jun), although this risk reducing thereafter. AR3709 in the southeast remains the largest region. It consists of a larger leader spot followed by some smaller trailing spots, although recent growth has stalled with some simplification occurring. The new regions in the southeast have shown some growth as they have become more visible with some minor flaring from AR3713. Accurate analysis is tricky currently due to foreshortening effects, and they will be analysed further as they rotate more into view. The remaining regions are mostly simple and stable or fading.

There is a chance of isolated M-class flares, with just a slight chance of X-flares initially, most probably from the declining AR3697 in the short term. The flare risk reduces into the period pending further developments.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	25	25	25	25
Very Active	R3 to R5 X Class	No	10	5	1	1

Figure 2: GOES-16 & -18 X-ray flux (gap in data due to planned network outage at SWPC)



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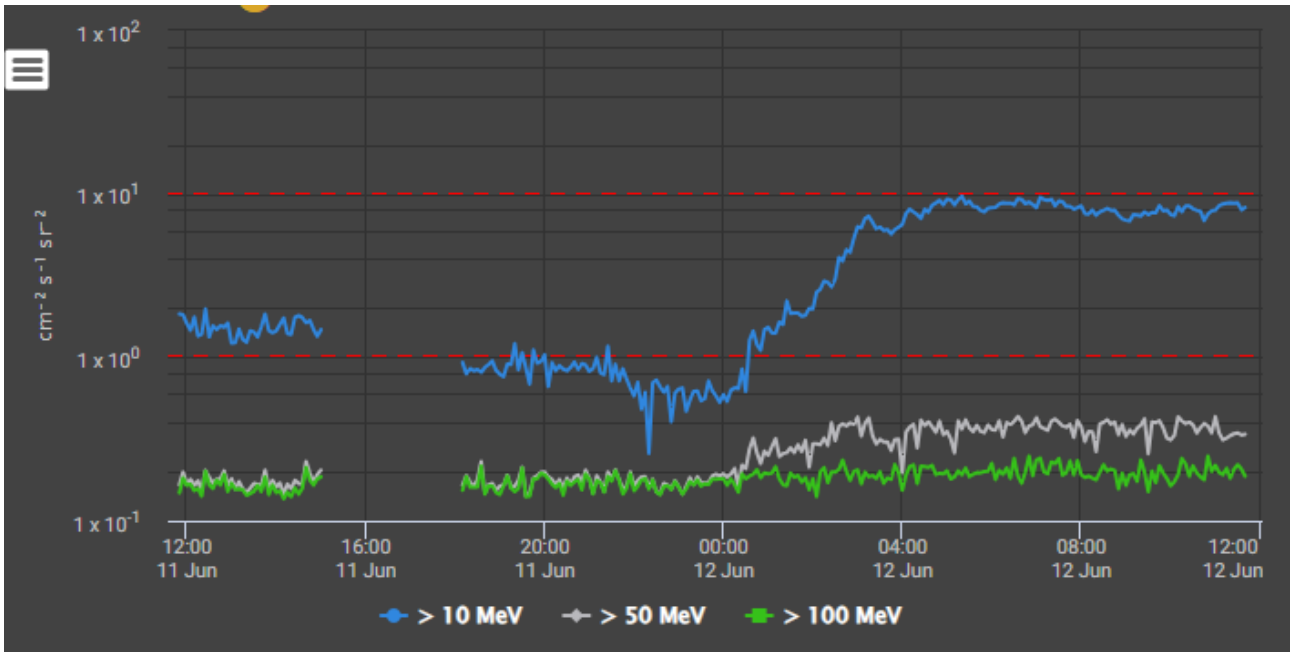
Solar Radiation Storms - (High Energy Protons):
Proton flux levels rose to almost S1/Minor solar radiation storm levels following a far-sided CME, possibly from the AR3697 region that has rotated around the western limb in recent days. Proton flux is expected to fall back following this event, but any further flaring from AR3697 could result in an enhancement to above the S1 threshold. This risk most likely on Day 1 (12 Jun), then easing through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	50	15	5	5
Very Active	**≥ S3 ***	No	5	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

Figure 3: GOES-18 Proton flux showing recent rise following far-sided CME (gap in data due to planned network outage at SWPC).



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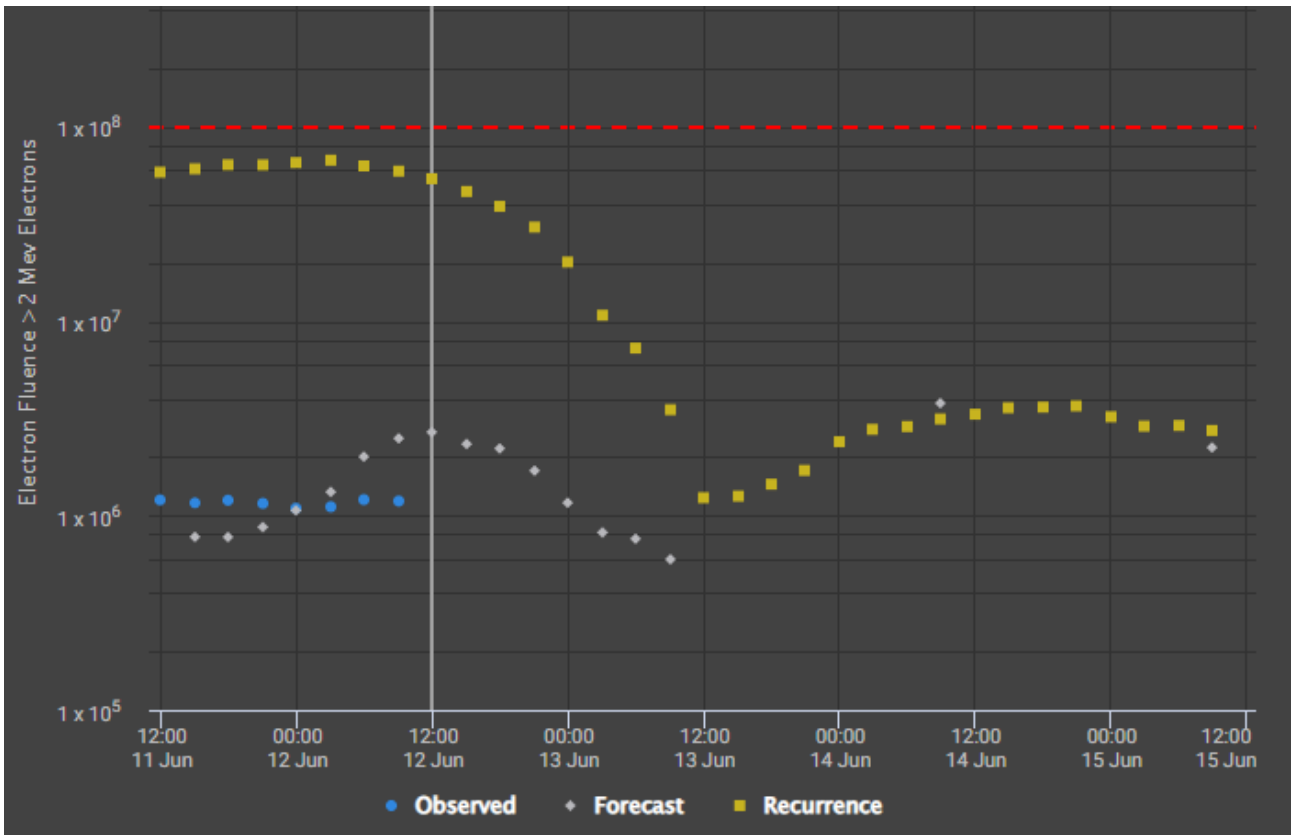
High Energy Electrons Event (≥ 2MeV):
The high energy electron flux is expected to persist at generally background levels for much of this period with limited significant sources of enhancement expected. Some diurnal Moderate flux values becoming likely into the period however.

MOSWOC REFM output now looks to be providing reasonable guidance with fluence expected to remain below the Active (1e8 integrated pfu) level through the period.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	1	1
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 4: MOSWOC REFM giving a reasonable guide, with fluence expected to remain below the Active threshold.



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